AMENDMENTS TO THE CLAIMS

[c1] 1. (Currently Amended) A multi-carrier, multi-cell, wireless communication network, comprising:

~~one of multiple~~a plurality of base stations,~~ providing communication coverage to a cell, and~~ each base station associated with one of a plurality of cells, having a transmitter that is synchronized in time and frequency with transmitters in other base stations in the plurality of cells, and configured to transmit cell-specific pilot subcarriers~~ and~~, cell-specific data subcarriers, common pilot subcarriers, and common data subcarriers within a same frequency band that is divided into a plurality of subcarriers, wherein:

the cell-specific pilot subcarriers and the cell-specific data subcarriers contain~~.~~ information concerning a specific cell, ~~a specific base station, or both, and~~ wherein at least some of the cell-specific pilot subcarriers are not aligned in frequency subcarrier index with cell-specific pilot subcarriers transmitted by other base stations and at least some of the cell-specific data subcarriers are not aligned in frequency subcarrier index with cell-specific data subcarriers transmitted by other base stations;

the common pilot subcarriers and the common data subcarriers contain information common to ~~a~~ the plurality of ~~the~~ cells,~~ the base stations, or both~~ wherein the common pilot subcarriers are aligned in frequency subcarrier index with common pilot subcarriers transmitted by other base stations and the common data subcarriers are aligned in frequency subcarrier index with common data subcarriers transmitted by other base stations; and

a mobile station in one of the plurality of cells, the mobile station ~~capable of~~ configured to receiv~~ing~~e the cell-specific pilot subcarriers and the cell-specific data subcarriers corresponding to the cell, and the common pilot subcarriers and the common data subcarriers corresponding to the plurality of cells ~~transmitted by the base station, and~~, wherein ~~the pilot subcarriers are employed in network operations~~the mobile station is further configured to:

determine cell-specific channel coefficients based on received signals on the cell-specific pilot subcarriers and apply the cell-specific channel coefficients to received signals on the cell-specific data subcarriers to compensate for cell-specific channel effects and to recover cell-specific information carried on the cell-specific data subcarriers, wherein the cell-specific channel corresponds to the channel from the base station in the cell to the mobile station; and

determine composite channel coefficients based on the received signals on the common pilot subcarriers and apply the composite channel coefficients to received signals on the common data subcarriers to compensate for composite channel effects and to recover common information carried on the common data subcarriers, wherein the composite channel corresponds to an aggregate of different channels from the plurality of base stations to the mobile station.

[c2] 2. (Currently Amended) The network of claim 1, wherein the common pilot subcarriers transmitted by different base stations are ~~aligned in frequency index at transmission time~~identical.

[c3] 3. (Currently Amended) The network of claim 1, wherein the ~~receiver~~mobile station estimates a frequency of a received signal by

$2\pi f_i \Delta t = \arg\{s_i^*(k)s_i(k+1)\} - \beta_i$, using common pilot subcarriers of a same frequency index *i* at different times t_k and t_{k+1}, provided that:

Δt << a coherence period of a communication channel;
$a_{i,m}(t_k) = c_i a_{i,m}(t_{k+1})$; and
$\varphi_{i,m}(t_k) = \varphi_{i,m}(t_{k+1}) + \beta_i$,

where:

$s_i(t_{k+1}) = e^{j2\pi f_i \Delta t} \sum_{m=1}^{M} a_{i,m}(t_{k+1}) e^{j\varphi_{i,m}(t_{k+1})}$ represents the received signal;

$c_i > 0$ and $-\pi \le \beta_i \le \pi$ are predetermined constants for the plurality of~~all~~ cells~~-m~~;

$\Delta t = t_{k+1} - t_k$;

s_i is the received signal in a p^{th} cell, at time t_k; and

$a_{i,m}(t_k)$ and $\varphi_{i,m}(t_k)$ denote signal amplitude and phase, associated with the i^{th} subcarrier from the base station of the m^{th} cell.

[c4] 4. (Currently Amended) The network of claim 1, wherein the ~~receiver~~mobile station computes a sampling period $T_s(t_k)$ ~~frequency difference, Δf, of two common pilot subcarriers, transmitted~~ at the ~~same~~ time t_k ~~but of different frequency indices *i* and *n*,~~ of a received signal by $2\pi\Delta f T_s(t_k) = \arg\{s_i^*(t_k)s_n(t_k)\} - \gamma(t_k)$, using two common pilot subcarriers, transmitted at the same time t_k but of different frequency indices *i and n*, provided that:

Δf << a coherence bandwidth of a communication channel;
$a_{i,m}(t_k) = c(t_k)a_{n,m}(t_k)$; and
$\varphi_{i,m}(t_k) = \varphi_{n,m}(t_k) + \gamma(t_k)$,

where:

$s_n(t_k) = e^{j2\pi\Delta f T_s(t_k)} \sum_{m=1}^{M} a_{n,m}(t_k) e^{j\varphi_{n,m}(t_k)}$ represents the received signal;

$c(t_k) > 0$ and $-\pi \le \gamma(t_k) \le \pi$ are predetermined constants for ~~all~~ the plurality of cells ~~m~~;

$\Delta f = f_n - f_i$ ~~and T_s denotes a sampling period~~;

$s_i(t_k)$ ~~s_i~~ is the received signal in a p^{th} cell, at time t_k; and

$a_{i,m}(t_k)$ and $\varphi_{i,m}(t_k)$ denote signal amplitude and phase, associated with the i^{th} subcarrier from the base station of the m^{th} cell.

[c5] 5. (Currently Amended) The network of claim 1, wherein phase diversity is achieved by the base station adding a random phase $(\vartheta_{l,m})$ to a l^{th} subcarrier such that:

$$\varphi_{l,m}(t_k) = \varphi_{l,m}(t_k) + \vartheta_{l,m} \quad \text{and} \quad \varphi_{l,m}(t_{k+1}) = \varphi_{l,m}(t_{k+1}) + \vartheta_{l,m},$$

where:

$\vartheta_{l,m}$ is different for each cell;

$\varphi_{l,m}(t_k) = \varphi_{l,m}(t_{k+1}) + \beta_l, \quad$ for all values of m;

$-\pi \le \beta_l \le \pi$ is a predetermined constant for ~~all~~ the plurality of cells ~~m~~; and

$\varphi_{l,m}(t_k)$ denotes phase at time t_k, associated with an l^{th} subcarrier from the base station of the m^{th} cell.

[c6] 6. (Original) The network of claim 1, wherein the base station is configured to apply power control to the pilot subcarriers by adjusting the power of the pilot subcarriers individually or in subgroups comprising a plurality of pilot subcarriers.

[c7] 7. (Currently Amended) The network of claim 1, wherein each of the ~~multiple~~ plurality of base stations include multiple antennas within an individual sector and employ multiple transmission branches connected to different antennas, and wherein for frequency estimation the common pilot subcarriers for each transmission branch are generated such that:

$a_{i,m}(t_k) = c_i a_{i,m}(t_{k+1})$ and $\varphi_{i,m}(t_k) = \varphi_{i,m}(t_{k+1}) + \beta_i$,

where:

$c_i > 0$ and $-\pi \le \beta_i \le \pi$ are predetermined constants for ~~all~~ the plurality of cells ~~m~~; and

$a_{i,m}(t_k)$ and $\varphi_{i,m}(t_k)$ denote signal amplitude and phase at time t_k, associated with an i^{th} subcarrier from a base station of the m^{th} cell.

[c8] 8. (Currently Amended) The network of claim 1, wherein each of the ~~multiple~~ plurality of base stations include multiple antennas within an individual sector and employ multiple transmission branches connected to different antennas, and wherein for timing estimation the common pilot subcarriers for each transmission branch are generated such that:

$a_{i,m}(t_k) = c(t_k) a_{n,m}(t_k)$ and $\varphi_{i,m}(t_k) = \varphi_{n,m}(t_k) + \gamma(t_k)$,

where:

$c(t_k) > 0$ and $-\pi \le \gamma(t_k) \le \pi$ are predetermined constants for ~~all~~ the plurality of cells ~~m~~; and

$a_{i,m}(t_k)$ and $\varphi_{i,m}(t_k)$ denote signal amplitude and phase at time t_k, associated with an i^{th} subcarrier from a base station of the m^{th} cell.

[c9] 9. (Currently Amended) The network of claim 1, wherein both the cell-specific pilot subcarriers and the common pilot subcarriers are used ~~jointly in a process~~

~~based on information theoretic criteria~~for frame synchronization, frequency offset estimation, or timing estimation.

[c10] 10. (Canceled)

[c11] 11. (Currently Amended) The network of claim 1, wherein a microprocessor computes attributes of the pilot subcarriers, specified by their requirements, and inserts them ~~into a frequency sequence~~in between data subcarriers contained in an electronic memory.

[c12] 12-30. (Canceled)

[c13] 31. (New) A method of generating transmission subcarriers in a base station in a multi-carrier, multi-cell, wireless communication system comprised of a plurality of mobile stations and base stations in a plurality of cells, the base station associated with a cell in the plurality of cells, including a transmitter that is synchronized in time and frequency with transmitters in other base stations in the system, and configured for generating different types of subcarriers within a same frequency band that is divided into a plurality of subcarriers, the method comprising:

generating common data subcarriers that carry data common to the plurality of cells to mobile stations in the plurality of cells;

generating common pilot subcarriers that possess characteristics common to other common pilot subcarriers generated by other base stations in the system, the common pilot subcarriers enabling a mobile station in the cell to determine composite channel coefficients and apply the composite channel coefficients to signals on the common data subcarriers received by the mobile station to compensate for composite channel effects and to recover common data carried by the common data subcarriers, wherein

the composite channel corresponds to an aggregate of different channels from the plurality of base stations to the mobile station;

generating cell-specific data subcarriers that carry data specific to the cell associated with the base station to individual mobile stations within the cell; and

generating cell-specific pilot subcarriers that possess specific characteristics, in phase, amplitude, or frequency index, corresponding to the cell associated with the base station, the cell-specific pilot subcarriers enabling a mobile station in the cell to determine cell-specific channel coefficients and apply the cell-specific channel coefficients to signals on the cell-specific data subcarriers received by the mobile station to compensate for cell-specific channel effects and recover cell-specific data carried by the cell-specific data subcarriers, wherein the cell-specific channel corresponds to the channel from the base station in the cell to the mobile station;

wherein:

the common pilot subcarriers generated by the base station and common pilot subcarriers generated by other base stations in the system are aligned in frequency subcarrier index, and at least some of the cell-specific pilot subcarriers generated by the base station are not aligned in frequency subcarrier index with cell-specific pilot subcarriers generated by other base stations; and

the common data subcarriers generated by the base station and common data subcarriers generated by other base stations in the system are aligned in frequency subcarrier index, and at least some of the cell-specific data subcarriers generated by the base station are not aligned in frequency subcarrier index with cell-specific data subcarriers generated by other base stations.

[c14] 32. (New) The method of claim 31, wherein cell-specific pilot subcarriers of the same frequency indices as cell-specific pilot subcarriers generated by adjacent base stations are not transmitted at the same time.

[c15] 33. (New) The method of claim 31, further comprising applying power control to the common pilot subcarriers, the cell-specific pilot subcarriers, or both, by adjusting the power of the corresponding pilot subcarriers individually or in subgroups.

[c16] 34. (New) The method of claim 31, wherein a phase difference between two common pilot subcarriers adjacent in frequency is the same for each of the plurality of base stations, and wherein a phase difference between two common pilot subcarriers adjacent in time is the same for each of the plurality of base stations.

[c17] 35. (New) The method of claim 31, wherein the specific amplitudes, phases, and frequency subcarrier indices of the cell-specific pilot subcarriers enable a mobile station in the cell to differentiate the cell-specific pilot subcarriers from cell-specific pilot subcarriers transmitted by base stations in other cells.

[c18] 36. (New) The method of claim 31, wherein within the plurality of cells, groups of two or more cells are associated together to form a plurality of groups of cells,

the common data subcarriers further generated so that they carry data common to the cell group that the base station is associated with, but different from other cell groups; and

the common pilot subcarriers further generated so that they possess characteristics common to the cell group that the base station is associated with, but different from other cell groups.

[c19] 37. (New) The method of claim 31, wherein at least part of the common pilot subcarriers, the cell-specific pilot subcarriers, or both, enable a mobile station in the system to perform frame synchronization, frequency offset estimation, or timing estimation.

[c20] 38. (New) The method of claim 31, wherein the common pilot subcarriers are transmitted on different antennas such that a phase difference between two common pilot subcarriers adjacent in frequency is the same for each antenna and a phase difference between two common pilot subcarriers adjacent in time is the same for each antenna.

[c21] 39. (New) The method of claim 38, further comprising applying power control to the common pilot subcarriers on each antenna by adjusting the power of the common pilot subcarriers individually or in groups.

[c22] 40. (New) The method of claim 31, further comprising generating the subcarriers in an orthogonal frequency division multiple access signal or a multi-carrier code-division multiple access signal.

[c23] 41. (New) A method of receiving frequency subcarriers by a mobile station in a multi-carrier multi-cell wireless communication system comprised of a plurality of mobile stations and base stations in a plurality of cells, the mobile station associated with a serving base station in a serving cell and including a receiver configured to receive different types of subcarriers within a same frequency band that is divided into a plurality of subcarriers, the method comprising:

receiving common data subcarriers that carry data common to the plurality of cells, the common data subcarriers transmitted by the serving base station

being aligned in frequency subcarrier index with common data subcarriers transmitted by other base stations in the system;

receiving common pilot subcarriers that possess characteristics common to the plurality of cells, the common pilot subcarriers transmitted by the serving base station being aligned in frequency subcarrier index with common pilot subcarriers transmitted by other base stations in the system;

receiving cell-specific data subcarriers that carry data specific to the serving cell, at least some of the cell-specific data subcarriers transmitted by the serving base station being not aligned in frequency subcarrier index with cell-specific data subcarriers transmitted by other base stations in the system; and

receiving cell-specific pilot subcarriers that possess specific characteristics, in phase, amplitude, or frequency subcarrier index, corresponding to the serving cell, at least some of the cell-specific pilot subcarriers transmitted by the serving base station being not aligned in frequency subcarrier index with cell-specific pilot subcarriers transmitted by other base stations in the system;

wherein:

composite channel coefficients are determined based on the received signals on the common pilot subcarriers and applied to the received signals on the common data subcarriers to compensate for composite channel effects and to recover the common data carried on the common data subcarriers, wherein the composite channel corresponds to an aggregate of different channels from the plurality of base stations to the mobile station; and

cell-specific channel coefficients are determined based on the received signals on the cell-specific pilot subcarriers and applied to the received signals on the cell-specific data subcarriers to compensate for cell-specific channel

effects and to recover cell-specific data carried on the cell-specific data subcarriers, wherein the cell-specific channel corresponds to the channel from the serving base station to the mobile station.

[c24] 42. (New) The method of claim 41, wherein a frequency of the signals received from the serving base station are estimated using common pilot subcarriers received at a first and a second time.

[c25] 43. (New) The method of claim 41, wherein a sampling period of the signals received from the serving base station are estimated using common pilot subcarriers received at a first and a second frequency indices.

[c26] 44. (New) The method of claim 41, further comprising determining frame synchronization, frequency offset estimation, or timing estimation based on the cell-specific subcarriers, the common pilot subcarriers, or both.

[c27] 45. (New) The method of claim 44, further comprising estimating a frequency offset based on the common pilot subcarriers, wherein the estimation is carried out in the time domain.

[c28] 46. (New) The method of claim 45, further comprising improving the accuracy of the frequency offset estimation based on the cell-specific pilot subcarriers, the common pilot subcarriers, or both, wherein the estimation is carried out in the frequency domain.

[c29] 47. (New) The method of claim 41, further comprising differentiating the cell-specific pilot subcarriers, based on their amplitudes, phases, and frequency

subcarrier indices, from cell-specific pilot subcarriers transmitted by base stations in other cells.

[c30] 48. (New) The method of claim 41, wherein the subcarriers are received in an orthogonal frequency division multiple access signal or a multi-carrier code-division multiple access signal.

[c31] 49. (New) A base station in a multi-carrier, multi-cell, wireless communication system comprised of a plurality of mobile stations and base stations in a plurality of cells, the base station associated with a cell in the plurality of cells, including a transmitter that is synchronized in time and frequency with transmitters in other base stations in the system, and configured for transmitting common pilot subcarriers, common data subcarriers, cell-specific pilot subcarriers, and cell-specific data subcarriers within a same frequency band that is divided into a plurality of subcarriers, wherein:

the common pilot subcarriers possess characteristics common to the plurality of cells, and the cell-specific pilot subcarriers possess specific characteristics, in phase, amplitude, or frequency index, corresponding to the cell;

the common pilot subcarriers transmitted by the base station are aligned in frequency subcarrier index with common pilot subcarriers transmitted by other base stations in the system, and at least some of the cell-specific pilot subcarriers transmitted by the base station are not aligned in frequency subcarrier index with cell-specific pilot subcarriers transmitted by other base stations in the system;

the common data subcarriers carry data common to the plurality of cells, and the cell-specific data subcarriers carry data specific to the cell; and

the common data subcarriers transmitted by the base station are aligned in frequency subcarrier index with common data subcarriers transmitted by other base stations in the system, and at least some of the cell-specific data subcarriers transmitted by the base station are not aligned in frequency subcarrier index with cell-specific data subcarriers transmitted by other base stations in the system.

[c32] 50. (New) A mobile station in a multi-carrier, multi-cell, wireless communication system comprised of a plurality of mobile stations and base stations in a plurality of cells, the mobile station including a receiver configured for receiving, within a same frequency band that is divided into a plurality of subcarriers, cell-specific pilot subcarriers and cell-specific data subcarriers transmitted from a serving base station in a serving cell in which the mobile station is associated, and common pilot subcarriers and common data subcarriers transmitted from the serving base station and other base stations in the system, wherein:

the common pilot subcarriers possess characteristics common to the plurality of cells, and the cell-specific pilot subcarriers possess specific characteristics, in phase, amplitude, or frequency index, corresponding to the serving cell;

the common pilot subcarriers transmitted by the serving base station are aligned in frequency subcarrier index with common pilot subcarriers transmitted by other base stations in the system, and at least some of the cell-specific pilot subcarriers transmitted by the serving base station are not aligned in frequency subcarrier index with cell-specific pilot subcarriers transmitted by other base stations in the system;

the common data subcarriers carry data common to the plurality of cells, and the cell-specific data subcarriers carry data specific to the serving cell; and

the common data subcarriers transmitted by the serving base station are aligned in frequency subcarrier index with common data subcarriers transmitted by other base stations in the system, and at least some of the cell-specific data subcarriers transmitted by the serving base station are not aligned in frequency subcarrier index with cell-specific data subcarriers transmitted by other base stations.